SHEAR-WAVE VELOCITIES OF THE POST-PALEOZOIC SEDIMENTS IN THE UPPER MISSISSIPPI EMBAYMENT: COLLABORATIVE RESEARCH BETWEEN THE UNIVERSITY OF KENTUCKY AND THE UNIVERSITY OF MEMPHIS

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INVESTIGATION UNDERTAKEN

The objective of this study is to determine the shear-wave velocities of the post-Paleozoic sediments at a representative set of seismograph station sites in the Upper Mississippi Embayment. Table 1 gives the coordinate location of the sites being investigated in this study. Near-surface (<150 m) *S*- and *P*-wave velocities at the sites have been estimated through the use *SH*- and *P*-wave reversed refraction/reflection profiling with a seismic hammer. The *S*- and *P*-wave velocities of the deeper sediments are being determined by a combination of long-offset *SH*-wave Vibroseis soundings, deep *P*-wave soundings using a vacuum-assisted weight drop, observed travel-time differences between the *S* and *Sp* phases (dt_{S-Sp}) of regional earthquakes recorded at seismograph stations in the study area, and drill hole data.

RESULTS

To date we have acquired seismic reflection and refraction data at the 19 sites across listed in Table 1. *P*- soundings and reversed *P*- and *SH*-wave near-surface (< 150 m) profiles have been acquired at all of the sites, and results from these investigations have been correlated with available drillhole data. The seismic data are processed, and the results have been correlated with available drill hole and dt_{S-Sp} data.

As part of the study, we have included a series of north-south sites that begin at the northern border of the Upper Mississippi Embayment, across that part of Missouri adjacent to western Kentucky, and to a deep (~260 m) accelerometer installation in southwestern Kentucky. The objective of this part of the study is to estimate the change in the *S*-wave velocities of the post-Paleozoic sediments as a function of their depth of burial, and assist in the interpretation of strong-motion records from the deep accelerometer as they become available.

NONTECHNICAL SUMMARY

The objective of this study is to derive well-constrained shear-wave velocities of the sediments in the Upper Mississippi Embayment. The thickness of the sediments varies from a few meters near the edges of the Embayment, to several hundreds of meters near the center. These sediment deposits are expected to have a profound influence on the ground motions in the area as a result of a damaging earthquake in the New Madrid seismic zone. Knowing the shear-wave velocities of the sediments, researchers will be able assess the hazard posed by earthquakes, as well as recommend mitigation strategies.

PUBLICATIONS

R. Street, E. Woolery, Z. Wang, and J. Harris (in review). Site effects at strong-motion stations in the New Madrid seismic zone, SAGEEP 2003.

AVAILABILITY OF DATA

P- and SH-wave seismic reflection and refraction data acquired in the study are being organized by site, and will be stored at the Kentucky Geological Survey as field and processed files. Along with the data files for each site, there will be information as to the location of the site, recording parameters, and other pertinent information. The seismic data will be stored in standard SEG format at the completion of the study, and available upon request. Requests for the information should be directed towards:

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TABLE 1

SITES INVESTIGATED

Site No.	Date (m/d/y)	Topo.	Lat/Long (°N/°W)	Elev.	P-(m)	SH-*
4001	3/6/02	Wyatt (Mo.)	36.971/89.207	96	X	X
4002	3/6/02	Wyatt (Mo.)	36.892/89.222	94	X	X
4003	3/6/02	Wickliff SW (Mo.)	36.849/89.209	93	X	X
4004	3/7/02	East Prairie (Mo.)	36.789/89.487	91	X	X
4005	3/7/02	Henderson Mound (Mo.)	36.720/89.473	90	X	X
4006	3/7/02	Wickliffe SW (Mo.)	36.776/89.244	91	X	X
4007	3/7/02	Bayouville (Mo.)	36.724/89.356	90	X	X
4008	3/27/02	Bondurant (Ky.)	36.554/89.332		X	X
4009	3/27/02	Lepanto (Ark.)	35.505/90.293	89	X	X
4010	3/27/02	Lepanto (Ark.)	35.505/90.293	68	X	
4011	3/28/02	Rosa (Ark.)	35.859/89.829	77	X	(715)
4012	3/28/02	Point Pleasant (Mo.)	36.411/89.556	86	X	(331)
4013	3/28/02	Charter Oak (Mo.)	36.715/89.734	87	X	(335)
4014	5/22/02	Wolf Island (Mo.)	36.738/89.215	92	X	X
4015	5/22/02	Hickman (Ky./Mo.)	36.616/89.241	91	X	X
4016	5/22/02	Henderson Mound (Mo.)	36.628/89.489	91	X	X
4017	5/23/02	Kewanee (Mo.)	36.696/89.584	88	X	X(326)
4018	5/23/02	Hills Store (Mo.)	36.671/89.751	87	X	X(336)
4019	5/23/02	Hills Store (Mo.)	36.723/89.863	88	X	X(337)

* Site numbers in parentheses are nearby (less than 1,500 m) sites from USGS Site Dynamic study (Street *et al*., 2001)